NIF Facts

Purpose

The National Ignition Facility (NIF) will use the world's largest laser to compress and heat BB-sized capsules of fusion fuel to thermo-nuclear ignition. NIF experiments will produce temperatures and densities like those in the Sun or in an exploding nuclear weapon. The experiments will help scientists sustain confidence in the nuclear weapon stockpile without nuclear tests as a unique element of the DOE's Stockpile Stewardship Program and will produce additional benefits in basic science and fusion energy.

The state of NIF construction early in 2000.

The Buildings

- NIF is 704 feet long, 403 feet wide, and 85 feet tall—about the size of a football stadium—and will consist of three connected buildings:
  - Optics Assembly Building (OAB)
  - Laser Building (LB)
  - Target Area Building (TAB)
- The $250 million, 7-acre NIF building complex is on schedule and within allocated budget (the laser and support equipment are behind schedule). The OAB and central plant construction is complete; the LB is more than 95% complete, and the TAB is due for completion in May 2001.
  - Concrete poured: 73,000 cubic yards
  - Steel and rebar put up: 12,700 tons
  - Earth moved: 210,000 cubic yards

The Laser System

- NIF's 192 laser beams will generate
  - A peak power of 500 trillion watts, 1000 times the electric generating power of the U.S.
  - A pulse energy of 1.8 megajoules.
  - A pulse length of three to four billionths of a second.
- Optical components: 7500 large laser slabs, lenses, mirrors, and crystals
  - more than 15,000 small optical components.
- Precision optics: total area of 33,000 square feet (3/4 of an acre). More than 40 times the total precision optical surface area in the world's largest telescope (Keck observatory, Hawaii).
- Laser beams: 16" by 16" beams of infrared laser light (1-micron wave length). The infrared beams are converted to ultraviolet beams (0.35-micron wavelength) at the target chamber.
- Laser pulse amplification:
  - In the master oscillator room, the initial pulse is amplified 10,000 times, then split 192 ways.
  - In the preamplifier module, each propagated pulse is amplified 20 billion times, then split 4 ways.
  - In the main laser system, each propagated pulse is amplified 15,000 times.
  - Total amplification = 3 quintillion (3 billion billion).

Laser and Optical System Cleanliness

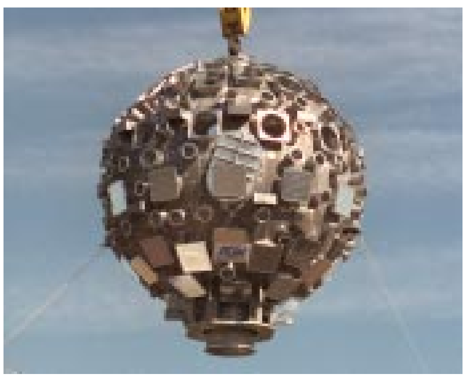
• The high optical intensities of inertial confinement fusion (ICF) lasers require the laser beampaths and optics to have a clean environment for reliable operation.

• NIF cleanliness requirements for optical assembly areas are 10 to 100 times less stringent than current semicon ductor fabrication plants.

• There are 400,000 square feet of structural surfaces in the NIF laser and beampath that require precision cleaning.

The Target System

- The target is contained inside a 30-ft-diameter, 1 million-pound aluminum/concrete target chamber, which resides within the 6-ft-thick concrete walls of the TAB.



The target chamber being placed into the TAB.

- In the 700 NIF experiments per year, target material will typically reach temperatures of 100 million degrees and densities 20 times that of lead, or 200 times that of water.
- NIF ignition targets consist of a cylinder of gold about the size of a cold capsule, within which is a BB-sized plastic sphere containing fusion fuel.
- During laser illumination, the BB-sized sphere is compressed to one-thirtieth of its original diameter before it ignites.

The NIF/ICF Program

- NIF experiments within the Stockpile Stewardship Program measure properties of materials and phenomena that occur at the extreme temperatures and pressures in nuclear weapon explosions so that weapon scientists can model, predict, and resolve problems that may be found in aging stockpile weapons—without resorting to nuclear tests.
- Basic scientific experiments will help astrophysicists understand the phenomena occurring deep within stars or at the instant the universe was created.
- Inertial fusion processes will be extensively studied on NIF. This will increase the likelihood of the development of fusion energy-based power plants.

Major Industrial and Institutional Participants

Allied Signal (Honeywell)
AstroPak
AT&T
Corning Glass
Cleveland Crystals
EG&G
Eastman Kodak
Emerson Electric
General Tool Company
Hensel Phelps
Hoya
Jacobs
Johnson Controls
Maxwell Laboratories
Neilsen Dillingham
PDM Ralph M. Parsons
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SVG Tinsley
Schott Glass
Spectra-Physics
TRW
Titan-Pulse Sciences Inc.
Zygo Corporation
Los Alamos National Laboratory
Sandia National Laboratory
University of Rochester/LLE
Argonne National Laboratory

Questions concerning the National Ignition Facility at LLNL should be directed to the LLNL Public Affairs Office, (925) 422-9919.